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NATURAL RESOURCES AND RURAL AGRICULTURE: IN BALANCE OR IMBALANCE?
THE EXAMPLE OF BOTSWANA'S RANGELANDS

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INTRODUCTION

1. Generally, little attention is given to the role of natural resources in economic development. This is particularly serious for developing countries (DCs), which depend on natural resources. Natural resources are commonly subdivided into renewable and non-renewable resources. Minerals are examples of non-renewable resources that are of strategic importance to many DCs; their revenues are a one-time benefit to society. Renewable resources concern wildlife species, over a long period but this is subject to proper management. Research and policy have so far made limited progress with respect to the integration of the environment into development planning (see e.g., Dasmann et al., 1973; Sandford, 1983). The concept of sustainable development -- as used by the World Commission on Environment and Development (WCED, 1987) -- has had a catalytic impact in focusing policy and research attention on the interdependence of development and environment: natural resources should be considered as an economic production factor.
2. This perspective contrasts with most traditional development theories which usually neglect the role of natural resources. However, one school of thought, represented by e.g., Boserup (1965; 1990) and Wilkinson (1973) focuses on the role of natural resources in development. In this view, land pressure (in the case of Boserup) and general imbalances between natural resources and human activities (Wilkinson) lead to four types of adaptations in human activities:
 - * adjustment of population numbers by means of migration and/or fertility changes;
 - * expansion of the natural resource base by territorial conquests and/or trade;
 - * intensification of agriculture; and/or
 - * economic diversification.

Both authors assume that such adaptations -- spontaneous or induced by government -- will lead to a new equilibrium, although they do not indicate how much time is required for that.

3. Boserup's and Wilkinson's theories may have been applicable to relatively closed societies in the past.^{1/} Present-day conditions are, however, quite different, casting doubts on the validity of the dominance of stabilising forces. We mention five potential sources of lasting natural resource imbalances. The first concerns the role of national governments in boosting development. Traditionally, few governments world-wide have taken the environment sufficiently into account (so-called government imperfections; see e.g., World Bank, 1987; Bojö et al., 1988) let alone specific rural environmental conditions. A bias towards short-term production increases is common in government programmes in order to rapidly meet basic needs. Recently, mounting environmental problems have increased environmental awareness among governments.
4. The second factor is the increasing influence of national and international factors on rural activities (e.g., the urban areas and international markets). These factors do not consider the rural natural resource base. Thirdly, socio-economic stratification is increasing, resulting in distinct economic groups or strata with different goals, socio-economic and ecological constraints and strategies. Consequently, it is likely that societal responses are heterogenous with an uncertain net impact on the resource base.
5. Fourthly, commercialisation implies an enhanced role of the market mechanism. Although the latter is an efficient and flexible allocation mechanism, it has significant environmental shortcomings (so-called market imperfections). Examples are that the market fails to take into account

external effects (including environmental ones); it does not apply to all natural resources (e.g., grass is often "free"); and it is based on imperfect knowledge of ecosystems. Finally, labour and capital constraints may be perceived by natural resource users as more urgent than environmental ones, hence their possible larger impact on human activities; this argument particularly applies to the short term.

6. Having cast doubts about a renewed natural resource equilibrium, this paper addresses itself to the following issues:

- i. assessment of the effect (balance or imbalance) of the present relationships between the natural resource base and human activities;

- ii. examination of the role of some potentially de stabilising forces, i.e. international markets, government programmes and socio-economic stratification; and

- iii. review of government's role in terms of its contributions to prudent natural resource management and options for the promotion of sustainable rural development.

7. In examining these issues, we use empirical 1987 survey data from two rural areas in Botswana. The international literature suggests that our findings have wider applicability.^{2/} In this context, the paper first summarises government policies towards natural resources, rangelands and the relevant economic sectors. It then introduces the study regions and compares regional developments in land use. The analysis of household strategies as a response to land pressure addresses the main aspects in general, and specifically as they relate to livestock production. The main findings in terms of the three issues spelled out in paragraph 6 above are summarised in the concluding remarks.

THE NATIONAL POLICY ENVIRONMENT

8. One may distinguish three areas of government activity which are important for natural resource management:
 - a. incentives or discentives for resource management, usually provided at the national level;
 - b. regulation of access to natural resources by means of land and water-use planning. Such planning is mostly carried out at the national and/or district level; and
 - c. direct support for the resource users, mostly at the local level.

Sustainable resource management requires reinforcing actions in all areas; sustainable resource management can easily be frustrated by conflicting signals to natural resource users. Below, we briefly characterise Botswana's overall resource management policies and other relevant sectoral policies.

Natural resource management

9. Assisted by the diamond boom and the related rapid increase in government revenues, the Government of Botswana has been able to develop various support programmes for sectors such as livestock, arable production and non-agricultural production. Until recently, the country did not have a comprehensive environmental policy. In December 1990, Parliament passed the new National Conservation Strategy. Its content was, however, unknown when this paper was being prepared.^{3/} Prior to the establishment of this policy, there were, however, a number of regulations to improve natural resource management. Economic instruments are rarely used for the purpose, and where they are used, instruments such as subsidies, prices and taxes are in most cases geared toward encouraging short-term production increases. Such a short-

term timeframe has potential negative environmental effects. Recently, policy changes have been proposed, including targeting of subsidies (e.g., to specific areas or groups) and more attention to potential environmental impacts of subsidies (MoA, 1990). Pending the implementation of the new environmental policy, one should be alert to the prevailing weaknesses in the management of natural resources, to the potential neglect of cross-sectoral effects, as well as to the inadequate coordination between sectors and the pursuit of ad-hoc solutions to environmental problems.

10. Land-use planning at district level is being strengthened at a rapid pace, and opportunities to control land use are improving substantially. However, water-use planning still appears primarily aimed at meeting demand, and is in effect rarely used to control societal activities (with the exception of the borehole-spacing policy discussed below). Until recently, the government has been hesitant to design policies for specific regions or population groups. Consequently, some programmes do not address essential regional issues or issues relevant to specific strata (e.g., arable support programmes in Western Botswana).

Instruments for rangeland management

11. Most instruments used to promote proper rangeland management are of a regulatory nature. Two laws guide access to and management of rangelands. First, the Tribal Land Act of 1970 regulates the allocation and management of tribal land. The Act gave substantial powers to district Land Boards (LBs), which may allocate land, cancel land rights and impose restrictions on land use. In addition, they may grant rights to groundwater (mostly boreholes) which is vital for cattle during the dry season. The LBs continued to apply the traditional rule that boreholes be 8 km. apart. This rule has been useful in limiting the extent of overgrazing; however, it has not proved adequate in preventing overgrazing from

occurring because the number of livestock remains uncontrolled and the rule does not incorporate regional differences and inter-annual variations in carrying capacity. Further, the Tribal Land Act does not either restrict or regulate the movement from freehold and leasehold land into communal land (so-called dual grazing rights).

12. Second, the Agricultural Resources Conservation Act of 1974 provides some opportunities for the rehabilitation of degraded rangelands by means of stock control and conservation orders. The act also creates opportunities to control the harvesting of scarce natural resources (e.g., thatching grass and certain wood species) by issuing licenses at a fee. The Agricultural Resources Board (ARB) is responsible for its implementation, but this body has so far not issued any such orders; instead persuasion and education are emphasised, but (for the time being?) without clear successes.

Livestock policies

13. The livestock sector attracts substantial government subsidies, and benefits from the high-priced EEC market in which Botswana has been allocated a beef export quota are directly passed on to cattle sellers; both factors add to the perceived comparative ecological advantage of the livestock sector (see Presidential Committee on Economic Opportunities, 1982; Fidzani, 1985). An effective veterinary service and good marketing facilities have contributed to the rapid expansion of this sector. During the 1980s, the slaughtering capacity for beef export purposes has expanded substantially with two additional Botswana Meat Commission (BMC) abattoirs in the north, making it more attractive to northern farmers to sell cattle to the BMC.
14. Because of government subsidies livestock holders do not pay the direct users' costs. Moreover, the livestock holders and

sector are not charged for the external environmental costs such as rangeland degradation and costs inflicted on other economic sectors (Perrings et al., 1988). During the 1980s, crop and small stock prices have been raised substantially, but the impact on investors' behaviour cannot yet be established due to the serious drought during 1981 to 1987.

15. In 1975, a White Paper on the Tribal Grazing Land Policy (TGLP) appeared with the dual aim of preserving rangelands and simultaneously increasing livestock production. TGLP's main components comprised a comprehensive land-use planning exercise, and the designation of tribal land for commercial (leasehold) ranching. TGLP also included additional elements for boosting commercial production on the ranches as well as livestock production in the communal areas. The latter was to be achieved by a reduction in stocking rates following the movement of large herds from the communal to the leasehold areas (Government of Botswana, 1975).
16. TGLP has been plagued by numerous problems, and it is generally considered unsuccessful in meeting its original objectives (for more details see Sandford, 1980; Bekure and Dyson-Hudson, 1982; CARG, 1984). For example, stocking rates did not drop in communal areas. The opposite most likely occurred because people had to move herds from the leasehold to the communal areas, and ranchers probably used their exclusive land rights only to increase their herds. Moreover, there is no evidence that livestock production increased. Assistance to livestock production in the communal areas has been limited. Trials with a top-down approach of community-based rotational grazing failed because, among other things, communities were unwilling to set aside part of "their" grazing land for exclusive use by a few community members (Sweet, 1987). Presently, bottom-up experiments are being carried out to establish alternative grazing management schemes.

17. In line with the deep-rooted, but yet unproven, conviction that fencing is necessary to boost livestock investments and better management, fencing of communal grazing land by individuals or communities has recently been proposed (MoA, 1990); we do not know whether this proposal has been translated into definitive government policy.

Policies towards other rural sectors

18. Presently, crop production and non-agricultural activities are the main alternatives to livestock production. Non-agricultural activities may comprise a wide range of activities such as beer brewing, construction work, firewood sales and formal employment in the public and private sector. Formal employment opportunities are concentrated in urban areas, hence many rural households have some members in urban areas. The terms of trade for crop production developed negatively until 1979 (as compared to livestock production). Stagnation of the arable sector has led to government schemes to increase crop production, mostly by means of subsidies for investments and recurrent costs. Most of these programmes did not take the natural resource base into account, and there is no conclusive evidence that yields per hectare have increased.
19. Since 1980 the Financial Assistance Policy (FAP) offered substantial subsidies for productive activities other than livestock production; arable activities were only eligible for FAP support if they were not covered under other government assistance programmes. FAP's major objective is to reduce the country's economic dependence on the mineral and livestock sectors. The non-agricultural sector grows rapidly, but remains subject to serious constraints such as the competition from South Africa and the small domestic market. The growth of this sector has been unable to alleviate mounting pressure on natural resources in the rural sector.

FEATURES OF THE STUDY REGIONS

20. Survey data were collected from two well-defined areas. The first study area is called Kgatleng, a district located immediately north of the capital Gaborone while the second study area is Palapye, which is part of Central District and is located in north-eastern Botswana (Map 1). The areas are of similar size (around 7,500 km²) and stocking rates exceed the estimated potential carrying capacity (PCC).^{4/} The present stocking rate expressed as a ratio of the PCC is 1.56 in Kgatleng and even higher in Palapye at 2.5. Although both regions are semi-arid, in comparison to Palapye region, Kgatleng has more productive soils, more rainfall and better groundwater prospects. Opinions of local farmers in both regions confirmed the poor state of the rangelands. Whilst in the past they had considered water as the major constraint to livestock development, lack of grass has now become the major bottleneck.
21. In terms of population and the related pressure on natural resources, the picture varies. Kgatleng has a higher population density (5.6 persons/km² compared to 1.7 in Palapye region) and a higher arable density, but Palapye region holds more livestock. The socio-economic stratification of both regions is fairly similar. Less than 20% of the households belong to the upper stratum (that is, households owning more than 40 heads of cattle), the remainder being almost equally divided between the middle (up to 40 cattle) and lower (no cattle at all) strata. In Palapye region, there are slightly more households without cattle (44% against 38% in Kgatleng).
22. There is an institutional difference between the two regions with important implications for access to natural resources, including rangelands. Traditionally, access to these resources has been confined to one's district. Although nowadays applications can be made for land or water rights

outside one's district, this is in practice difficult and still rare. Kgatleng is a district and has its own administrative-institutional structure. In contrast, the Palapye region is a sub-unit of Central District, administered by district institutions some 70 km away. The implication of this institutional difference is that Kgatleng's rangelands can almost exclusively be used by its inhabitants; Palapye region's rangelands can be utilised by people from outside the area as indeed happens. It is estimated that as much as 80% of the livestock in Palapye region are owned by households from elsewhere in Central District.

A REGIONAL COMPARISON OF DEVELOPMENTS IN LAND USE

Land use patterns

23. The two regions manifest different land use patterns. In Kgatleng, people and crop production are concentrated in the south. Around 25% of the district's land area is under mixed farming where also 90% of the people and arable land (annual cultivation between 15,000 and 20,000 ha.), and some 30% of the livestock are found (Opschoor, 1981). In contrast, Palapye region is a "cattlepost area"; mixed-farming areas constitute approximately 7.5% of the surface, mainly around the villages; some 10,000 ha. of land is annually cultivated. There are few villages and the percentage of residential land is lower than in Kgatleng. Below, we discuss in more detail some frequently applied adjustments to increasing land pressure.

Adaptation to land pressure

24. As a first response, agriculture usually encroaches into land previously left to hunter-gatherers and/or wildlife. Since both regions are presently almost fully occupied by either livestock or crops, adjustment through such an encroachment

process has virtually stopped. This is reflected in the current inability of the Land Boards in both regions to allocate new boreholes.

25. Expansion of rangelands for livestock in the past has generally been most beneficial to the upper stratum because of the relatively high investments and operational costs associated with expansion. Despite this, we found a significant regional difference in the overall access to rangelands. In Kgatleng, the borehole technology has been a socio-economically discriminating requirement for expansion of grazing areas; the average herd size of members of borehole groups is three times the district's average (88 and 27.5 respectively (Peters, 1983)). In Palapye region, rangelands are more easily accessible mainly because of the cheaper and the more equitable ownership of wells. As a result, the average herd size of well owners is 28.5 which is the same as the district average (see Table 4).
26. A second type of adjustment has been the conversion of rangelands into arable land. This process usually starts around the village, and gradually spreads further away; population density influences the distance of arable fields from villages. Given the higher population density of Kgatleng, it is not surprising to find that the average distance to arable fields in Kgatleng is twice that in the Palapye region (12.2 km and 6.4 km respectively). The upper stratum can afford to cultivate distant fields whilst the lower stratum often retain old fields near the villages (as we found around Kgatleng's capital Mochudi).
27. Cattle owners frequently put the blame for overstocking on arable encroachment. The aerial-photo analysis over the period 1950-1982 showed that arable encroachment does occur, but it is at most a secondary cause for overstocking. In Kgatleng rangeland losses due to arable encroachment between 1963 and 1982, were estimated at about 2.5% of the total

rangeland area. Continuation of this trend would mean that all rangelands would be converted into mixed farming areas in 35 to 45 years. However, the vested interests of borehole owners and the strengthened implementation of land-use planning are likely to prevent this from happening.

28. The third response to land pressure has been to engage in mixed farming, especially among small-herd owners, where crop and livestock production are spatially combined throughout the year. These areas are usually located between settlements and the more remote rangelands. Mixed farming has resulted from two (push and pull) factors which are closely related to land pressure. The major push factor has been the loss of access to both groundwater and surrounding rangeland grazing. With increased pressure on the rangelands, purchasing of water became more difficult, and membership rates of syndicates have become prohibitive for small-herd owners.^{5/} A major pull factor has been the need to economise on labour. Other benefits include the proximity of draught power and milk.
29. Farmers consider mixed farming a necessity, but are fully aware of serious disadvantages. First, mixed farming exposes farmers to frequent crop damage by cattle. Approximately two-thirds of the farmers experienced such damage in Palapye.^{6/} Fencing significantly reduces the frequency of crop damage. As shown in Table 1, the higher the frequency of crop field fencing the lower the frequency of crop damage. Further, since stratification and fencing are positively correlated, there is an inverse relationship between strata and crop damage: crop damage affects the lower and middle strata most seriously.

Table 1. Fencing and crop damage by socio-economic stratum in Palapye Region, 1987 (% of crop producers).

Stratum	Frequency of Crop Damage	Frequency of Fencing of Fields
Upper stratum	30.4	84.0
Middle stratum	49.1	56.7
Lower stratum	85.5	20.8
Average	64.4	42.1

Source: Arntzen (1989).

30. Poorer grazing conditions in mixed-farming areas are a second major disadvantage. In Botswana as a whole, stocking rates in mixed-farming areas are double those in pure rangelands. In Kgatleng district, a similar pattern was found, but the difference between mixed farming areas and pure rangelands was smaller. Important potential benefits of mixed farming such as more frequent use of manure and fodder appear presently not feasible to most farmers because of labour constraints.

Land pressure and farmers' perceptions

31. It appears a reasonable proposition that farmers' views on future land availability are a function of perceived land pressure; these views are likely to be part of the present household strategies. For example, we found in Kgatleng that at present farmers acquire more land mostly to safeguard their children's interests. In Palapye region we examined farmers' views on the future availability of land in more detail (Table 2). A great deal of uncertainty exists around the future of rangelands: 40% of the farmers have no opinion on the future availability of rangeland for livestock compared with only 3% in the case of arable land. Future land shortage for both arable and livestock production is a

widespread concern, but farmers appear most pessimistic about rangelands. Sixty percent of the farmers with an opinion predicted a shortage of rangelands. This permission may diminish when arable encroachment will be restricted through better (enforced) land-use planning.

Table 2. Perceived availability of land for livestock and crop production in Palapye Region, 1987 (% of households).

Palapye Region	Yes	No	Do not Know
Sufficient land for <u>livestock</u> available in future?	23.6	36.4	40.1
Sufficient <u>arable land</u> available in future?	51.9	44.8	3.3

Source: Arntzen (1989).

RURAL HOUSEHOLD STRATEGIES AND LIVESTOCK MANAGEMENT

Sources of household income

32. Rural households can be seen as multi-sector, multi-resource production units. For a proper analysis of livestock management, we first have to understand the overall household situation and strategies. The majority of households in both regions derive income from agricultural and non-agricultural activities. Non-agricultural activities (e.g. wage employment, services, construction, remittances, etc.) have important functions as necessary supplements for subsistence

in general, and for increased subsistence security in times of drought. This is demonstrated in Table 3 for the Palapye region. Non-agricultural activities were the most important source of income for two-thirds to three-quarters of the households. Cattle, crops and small stock follow as main sources in order of general importance. Smallstock provided useful supplementary income during the drought of the 1980s. Income from crop production was very limited even before the drought. Thus, a picture emerges of two leading economic activities (non-agriculture and cattle) supported and supplemented by small stock and crop production.

33. Table 3 shows clear stratum-related differences in terms of the diversity of income sources and stability over time. The upper stratum has a relatively reliable mix of income sources with primary income coming from cattle and non-agricultural activities, and secondary ones from cattle and small stock. On the other end, the lower stratum primarily depends on non-agricultural activities, and crop production as a secondary source. For the lower stratum, the latter source in particular has been subject to wide variations over the years. The middle stratum holds an intermediate position. Finally, it is important to note that the upper stratum is usually also most active and successful in crop and small stock production. Table 4 presents data, among others, on the size of livestock holdings, average crop yields and small stock flock size (Palapye) by stratum.
34. What are the general implications of socio-economic stratification for households' options to adjust to land pressure? Stratification is found to be positively related to ownership of transport and equipment such as boreholes and tractors (Table 4). This finding confirms that adjustment opportunities to mounting land pressure as discussed above, are generally more feasible for the upper stratum. Furthermore, there is a (defined) positive relationship between strata and cattle as the main source of rural wealth.

Around 45% of the households do not hold cattle; another 25% have too few animals to raise cash or to use own draught power without negative impacts on their herd (Arntzen, 1989).

Table 3. Household income by sector and stratum in Palapye Region, 1980 and 1987 (% of households).

Stratum	<u>Before the Drought (1980)</u>				<u>Situation in 1987</u>			
	Non-Agric.	Cattle	Crops	Small-stock	Non-Agric.	Cattle	Crops	Small-stock
Main source of income								
Upper	43.5	39.3	17.3	0.0	53.6	44.0	0.0	2.4
Middle	47.2	38.5	9.2	5.0	56.2	37.6	0.0	6.2
Lower	83.3	4.6	7.4	4.6	95.4	0.0	0.0	4.6
Average	63.0	23.3	9.2	4.5	72.6	21.5	0.0	5.9
Secondary source of income								
Upper	32.5	50.0	3.3	14.2	31.1	37.1	0.0	31.8
Middle	20.0	42.1	6.3	31.5	15.1	37.6	1.4	45.8
Lower	24.6	16.5	18.4	40.5	12.2	0.0	22.2	65.6
Average	21.9	37.6	12.7	27.8	15.4	28.8	3.5	52.4
Tertiary source of income								
Upper	17.9	8.3	34.5	39.3	22.6	26.2	51.2	0.0
Middle	29.3	10.9	16.5	43.4	36.3	22.7	36.7	4.3
Lower	0.0	6.7	27.8	65.6	0.0	0.0	100.0	0.0
Average	25.0	12.0	18.3	44.7	30.9	24.9	41.9	2.3

Note: Rows add up to 100% for each year; non-agric. = non-agricultural income.

Source: Arntzen (1989).

These households will find it very difficult to meet basic needs and face a highly insecure economic situation. They are therefore likely to adopt a short-term survival strategy.

Table 4. Selected characteristics by stratum and region, 1980 and 1987

Region and Characteristic	<u>Socio-economic Stratum</u>			Ave- rage
	Upper	Middle	Lower	
<u>Kgatleng (1980):</u>				
Average herd size	41	19	0	28.2
% of borehole owners	27	6	0	16.2
Average cultivated area				
(ha./hh.)	5.3	4.2	1.7	4.5
% of tractor owners	6	0	0	2.1
Average yields (kg./hh)	833	252	91	413
% of female-headed hh.	18	18	31	23
<u>Palapye Region (1987):</u>				
Average herd size				
a. cattle	85	18	0	28.6
b. goats	28	16	8	14.9
% of borehole owners	13	0	0	2.8
% of well owners	46	54	0	44.6
Average cultivated				
Area (ha./hh.)	6.1	3.6	2.5	3.6
% of tractor owners	37	0	1	4.3
Average yields (kg/hh)	59	48	6	35
% of hh. with transport	93	60	17	43
% of hh. with fields	98	99	94	98
% of hh. with goats	98	85	52	75

Note: hh.= household.

Sources: Opschoor (1981); Arntzen (1989).

Herd holding and livestock management

35. There is no evidence that regional differences in stocking rates have influenced household involvement in livestock production, or the size of the average herd holding by households. In both regions, roughly 45 to 50% of the rural households do not hold any cattle. The average herd size is just under 30 in both regions. Although goats have a comparative advantage in degraded areas, we did not find a significant difference in the size of goat holdings in the two regions (Arntzen, 1989). The size of goat holding was found to be positively related to socio-economic stratification. Nonetheless, small stock do offer additional income opportunities to households with no cattle (Table 4). Opschoor (1981) estimated that 32% of the lower stratum households keep small stock in Kgatleng; in Palapye, the corresponding figure was 52%.
36. Overstocking could be an incentive for increased sales of cattle. This was not confirmed by our data. Off-take proved to be positively related to stratification, the upper stratum selling more frequently and in larger numbers. Cash needs are the most frequent reason for selling in both regions. Marketed offtake rates greatly fluctuate within regions and between years.
37. Livestock management in Botswana typically involves some herding and a prudent fallback strategy to secure year-round water for livestock. Apart from watering costs, cash expenditures are generally limited. Table 5 summarises management practices found in the study regions. The differences in herding practices between the two regions are not large. On the other hand, feeding practices show large differences. In the Palapye region, 44.5% of the livestock holders gave fodder to their livestock, compared with only 10.3% in Kgatleng in 1980 -- i.e. prior to the drought. The difference can probably be attributed to government subsidies

for fodder in 1987 -- a drought year. The necessity to provide fodder appears to have been at the expense of other inputs such as salt and bonemeal. Proper fences have the advantage of private use of crop residues or grass inside the fence. In Palapye region, an estimated 23.8% of the crop producers use the residues for their own cattle only. No comparable data are available for Kgatleng.

Table 5. Selected livestock management practices by region (% of cattle holders)

Management Practices	Kgatleng (1980)	Palapye (1987)
Location:		
Cattlepost	53.8	54.6
Mixed farming area	46.2	45.4
Herding practices:		
Permanent herding	9.0	11.2
Hiring labour	19.2	26.2
Movement of cattle	n.a.	10.1
Feeding practices:		
Salt and bonemeal	31.6	8.9
Fodder	10.3	44.5
Private use of crop residues	n.a.	23.8

Source: Arntzen (1989).

38. Management practices are generally positively related to stratification. The upper stratum employs more varied management practices and more hired labour than the average livestock holder. For example, in Palapye, the upper stratum households hired labour more frequently (64.4% versus the average of 26.2%), were able to provide permanent herding more frequently (28.5% versus 11.2%) and gave fodder more regularly (68.5% versus 44.5%). Fodder subsidies thus benefit the upper stratum mostly. The upper stratum also makes better

39. The surveys showed interesting differences in livestock watering due to different physical conditions both within and between the two regions. For example, in eastern Kgatleng, 90% of the farmers get their water supply for livestock from a river throughout the year (free of charge). Elsewhere in the region, livestock holders rely on costly boreholes, particularly during the dry season. In Palapye in contrast, 94% of the livestock holders use wells. These differences have an important implication for access to groundwater and subsequently to the surrounding grazing areas. In Palapye region, the majority of the middle stratum (54%) has guaranteed access to groundwater as compared to 6% in the Kgatleng region. As a result, the positive relationship between ownership of groundwater and strata, which was found in Kgatleng and which is typical for Botswana as a whole, does not hold for the Palapye region. In Palapye, access to groundwater and rangelands is less skewed. This finding is of particular importance because livestock holders presently consider lack of grass the main constraint to livestock development. Opschoor (1981) found that grass had become the most common constraint in Kgatleng; subsequent surveys in the same district as well as in the Palapye region confirmed this finding. Apparently, farmers are better able to resolve water problems than grazing ones.
40. In order to ascertain the impact of drought on livestock development, we asked livestock holders in Palapye region to compare pre-drought conditions (1981) with those prevailing during the 1987 (drought year) field-work. Although grazing conditions had deteriorated substantially, they were already far from good in 1981. Whilst in 1987 93% of the livestock holders judged rangelands to be in bad shape, the majority of farmers (55%) considered the availability of grazing to have been already poor in 1981. From this, we may conclude that inadequate grazing is a structural problem but also one which is occasionally enhanced by droughts.

CONCLUDING REMARKS

41. Regarding the issue of balance or imbalance, the available evidence suggests an imbalance exists between rangeland use and its regeneration. A general indication is revealed by the fact that regional stocking rates exceed the potential carrying capacity. In addition, and perhaps more important, farmers themselves consider lack of grazing as the most important constraint to livestock development. It was found that this view also existed before the drought period during which field-work was conducted. A historical analysis of both regions -- the results are not discussed in this paper -- shows that the imbalance in rangeland use dates as far back as the 1950s (Arntzen, 1989). In other words, the imbalance has been in existence over a considerable period. Finally, mixed farming may be seen as a spontaneous adaptation to the mounting pressure on rangelands. However, there are no data available which could shed light on the nature of the imbalance in terms of rangeland productivity.
42. Regarding the role of destabilising factors, strong national and international incentives have encouraged the expansion in livestock numbers, adding to the established comparative ecological advantage of livestock production in semi-arid areas. Little attention has been paid by government to incorporating environmental considerations into macroeconomic and livestock development planning. Most general and sectoral policies do not (yet) differentiate for the constraints facing specific groups or ecological zones, and therefore may not address the needs of specific areas and rangeland users. This overall context has probably hampered existing activities and policy instruments from being directed specifically towards improving of rangeland management.
43. Socio-economic stratification has proved to be an important determinant of household strategies and constraints in general and for livestock development in particular, and of

adjustment opportunities in terms of expansion and intensification. For example, the ownership of household assets and the management practices pursued by farmers were found to be clearly stratum-related: ownership of transport means, hiring labour, provision of fodder and bonemeal, fencing of fields in order to prevent crop damage by cattle. Moreover, data for Kgatleng showed that the upper stratum (over 40 head of cattle) has better access to groundwater than the middle stratum. This is typical for Botswana as a whole, although data for the second study region showed more egalitarian access to groundwater and surrounding rangelands because of the existence of wells with considerably lower investments and running costs. Thus overall, small-herd owners are increasingly being marginalised, and may be forced to drop out of the livestock sector. Finally, our field-work showed that labour is an important constraint to rural activities.

44. The government's awareness of environmental matters is rapidly increasing and a number of measures have been made or suggested. These include the preparation of a comprehensive environmental policy. Regarding the livestock sector, changes in the livestock pricing system are under consideration, the slaughtering capacity has been expanded, land-use planning and enforcement is being strengthened, and recently it has been suggested to target subsidies and give due consideration to external environmental impacts of livestock development. These measures are steps in the right direction; the systematic integration of environment in macroeconomic and sectoral development planning is especially considered important.*

* Editor's note: A Government White Paper on Agricultural Development Policy approved by Parliament in February 1991, includes most of the points raised here by the author.

45. This paper suggests additional (or more detailed) areas for consideration. First, more explicit use of economic instruments (e.g., reconsideration of the present pricing and subsidy schemes, negotiable grazing licenses also issued to non-cattle holders and adjustable to the carrying capacity). Such instruments could assist in controlling rangeland pressure and increase the effectiveness of existing stock and conservation orders. Second, the role of water planning as a control instrument of rangeland use could be further enhanced (e.g., fees for water use). However, proper coordination with land use planning is required. Third, the terms of trade between rural sectors could be manipulated to promote qualitative improvements in livestock production instead of expansion in numbers. This requires an assessment of government support and external costs of individual sectors. Fourth, some important livestock development issues are: safeguarding the marginal position of small-herd owners (unless sufficient alternative income opportunities exist), resolution of the unrestricted access to communal areas by freehold and leasehold ranchers (dual grazing rights).
46. The survey established a relationship between socio-economic stratification and access to rangelands as well as a relationship between socio-economic stratification and household strategies and the nature and scale of their activities. Government policies need to take these relationships into account by targeting towards specific strata and physical conditions of regions, not only in terms of carrying capacity but also in terms of access to grass and groundwater.

Map 1: Botswana and the study regions

FOOTNOTES

1. Presently, developing countries face a restricted choice of adaptations in comparison with the developed countries in the past. The following options have become very limited: emigration opportunities, territorial expansion, expanding the resource base through trade (in fact the reverse occurs), and economic diversification (because of protectionism in developed countries).
2. The following sections are based on Arntzen (1989). The reader is referred to this publication for more details.
3. This implies that some of the points and suggestions made in this paper may have been addressed in this new policy. This can only be assessed by an analysis of this policy at a later stage.
4. PCC in Palapye region ranges from 16 to 21 hectares per livestock unit (ha/lsu); the corresponding figure for Kgatleng is 12 to 16 ha./lsu.
5. Charges are usually flat rates per member. Therefore, the watering costs per LSU are highest for the smaller herds.
6. No estimates of the magnitude of crop damage are available. It is hard to collect reliable data by questionnaire; moreover, during the drought yields were already low regardless of whether crop damage had occurred or not.

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MEMORANDUM NOTES

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